Drought Monitoring in Oklahoma: *A Collaborative Endeavor*

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Oklahoma Climatological Survey

Oklahoma Mesonet

The Recipe:
- Reliable and accurate data
- Always-on access, updated daily before sunrise
- Multiple products and indices meet varying needs and learning styles

The Result:
- More effective use of time for both data provider and data client
- Flexible drought monitoring need for various Oklahoma interests

Some Key Points

Don't have a Mesonet? No problem. Any reliable, high-quality daily rainfall information can be used to develop similar monitoring tools. Some facets (such as soil moisture, fire danger conditions and KBDI) do require additional sensors and temporal resolution.

The climate-based system is only one component of the future National Integrated Drought Information System. Weather and climate information captures important *inputs* into drought conditions (the "supply side"), *but it does not measure impacts or demand.* Decision-makers need tools like OCS's drought-monitoring system, but its usefulness will be multiplied when coupled with databases for observed impacts, demand, and available water supplies.

The OCS system currently provides assessment only. It does not predict whether observed trends will continue. Short range and seasonal forecast information will allow decision-makers to foresee problems and take action before the onset of drought conditions.

Oklahoma's Drought Monitoring System: *A Development and Collaboration Timeline*

1995-96: Winter season drought develops in Oklahoma devastating the wheat crop. OCS uses the Oklahoma Mesonet to obtain daily rainfall totals by climate division. Mesonet totals are used to compute departure from normal and percentage of normal to add context. Maps are created weekly and faxed to the officials on Oklahoma's Drought Monitoring Team.

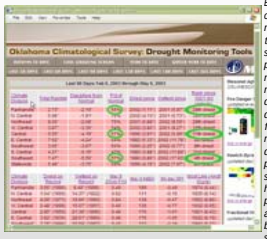
1998: Oklahoma endures a sweltering six-month summertime drought and heat wave. Weekly tables of precipitation, departure, and percentage of normal for each climate division are now published on the web. Color-filled contoured maps show Mesonet data compared against normals.

2000: Oklahoma is struck by a severe, short-lived summertime drought. Tabular statistics and color-filled maps are now updated daily – and automatically. Based on feedback from the Oklahoma Water Resources Board, OCS provides data for three "seasons" (year-to-date, season-to-date, and water-year-to-date).

2001: Work continues on the drought monitoring website, even during the times when drought is not prominent in the state. Additional fields are added to provide more context to the departures from normal. Production is expanded to include "moving window" periods (e.g., 30, 60, 90 days) to avoid early-month assessment problems, when only a few days of data are available.

2003: Additional drought indices are added to the suite of statistical and historical data. New indices include a soil moisture index based on the Mesonet's soil moisture sensors, Keetch-Byram Drought Index from the Mesonet's Fire Danger model, and Standardized Precipitation Index calculated from historical COOP data are added. Feedback from public safety officials who deal with smoke management leads to inclusion of real-time data from the Oklahoma Dispersion Model. Analog years are added, based on similarity scores for corresponding historical periods. Oklahoma's system is promoted as an example of part of a prototype system for the National Integrated Drought Information System.

2005: Based on a grant from the National Climatic Data Center, OCS develops a daily feed of Cooperative Observer data to compare against the Mesonet-based results. The data are updated daily through an automated feed from the Southern Regional Climate Center. Early results indicate a sufficient number of Oklahoma COOP stations are available on a real-time (daily) basis to allow for comparison.



Basic statistics can be misleading! In this example, similar percent-of-normal values mask vastly different departures from historical norms. OCS drought products supply historical perspective alongside basic statistics.

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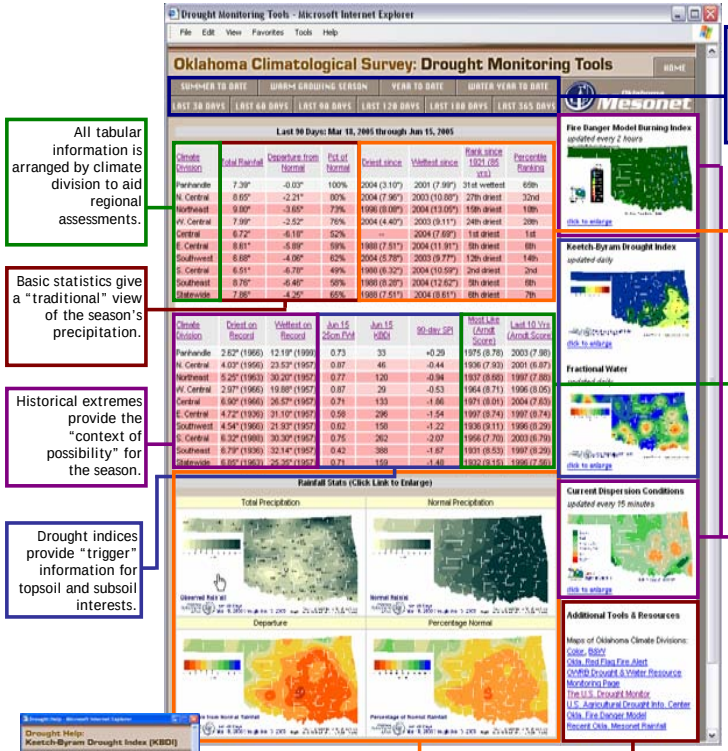
Comprehensive Real-time Drought Information for Oklahomans
http://climate.ocs.ou.edu/rainfall_update.html

Before sunrise daily, real-time rainfall and soil moisture data from the Oklahoma Mesonet are assimilated into summary information, modeled fire danger conditions, smoke dispersion indices and other drought-related products. For products and indices that require a long-term perspective, Mesonet data are compared to records from the NWS Cooperative Observer network. The OCS drought report is **automatically updated and immediately available** on the web.

The automation of the report allows drought decision-makers instant access to the latest precipitation, fire danger and soil moisture data when they arrive at their desk, 24 hours per day, seven days per week. The automation helps maximize the reader's efficiency by eliminating the need to prompt (and wait for) action from OCS. It also helps OCS staff reduce the time spent preparing reports and focus on more valuable interpretive and explanatory support.



All tabular information is arranged by climate division to aid regional assessments.

Basic statistics give a "traditional" view of the season's precipitation.

Historical extremes provide the "context of possibility" for the season.

Drought indices provide "trigger" information for topsoil and subsoil interests.

Ten "seasons" are updated daily to provide the most appropriate time-scale for the client.

Rankings and comparisons provide valuable historical perspective.

Analog seasons appeal to personal and institutional memory.

Modeled fire danger information and smoke management tools serve fire and public safety personnel.

Links to other agencies and resources opens a comprehensive (not just meteorological) point of view.

Enlargeable summary maps provide an at-a-glance assessment of statewide conditions.

Because many drought decision makers come from outside the geosciences, online help is available for each OCS drought product.

Prominent users of the OCS drought monitoring system provide valuable design input and feedback

Oklahoma Water Resources Board. As the lead agency for monitoring drought in Oklahoma, OWRB staff rely upon the OCS drought package. Data from the website are routinely included in the *Water Resources Bulletin*, the key vehicle for communicating drought conditions to the leadership of other state agencies, the Governor's office, and state legislators.

U.S. Drought Monitor authors. The automated website is used by the authors to develop weekly assessments of drought conditions in Oklahoma. OCS data complement other independent data sources (such as indices computed by NCDC) to increase the author's confidence in their assessment. Several authors provided valuable feedback during development of the pages and fields and served as 'beta-testers' for new changes.

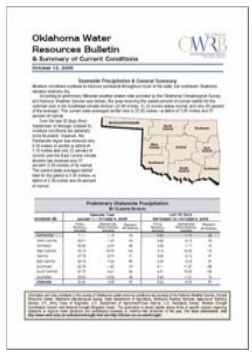
Western Governors' Association. At the request of the WGA, OCS developed a companion document to the WGA's National Integrated Drought Information System (NIDIS) plan. The document was used as a concrete example of how real-time precipitation information can be used effectively by states to respond to and manage drought.

Broadcast and print media. Data from OCS's drought monitoring system is commonly published during drought, and even during excessively rainy periods. This greatly increases OCS's ability to communicate with the media and public. Conversations with media members now focus more on cause and effect, rather than data gathering.

Oklahoma Fire Marshall and Governor's Office. The state officials responsible for Red Flag Fire Alerts and gubernatorial burn bans routinely consult OCS's drought indices while making policy decisions.

Water Resources Bulletin: *A Decision-Makers' Summary*

As the chair agency of the monitoring committee of the state's Drought Management Team, the Oklahoma Water Resources Board (OWRB) issues the *Oklahoma Water Resources Bulletin*, a regular publication that monitors drought and moisture conditions in Oklahoma. Utilizing data collected from the numerous state and federal agencies and organizations, the report includes current information on reservoir storage, stream flow conditions, crop conditions, weather conditions, and related factors. The Bulletin, published weekly during drought episodes, is a key component of the OWRB's continuous drought monitoring effort and the Oklahoma Drought Management Plan. The OCS drought monitoring tools provide OWRB staff with current information about moisture deficits for local and regional areas of the state on a variety of time scales. OWRB staff do not have to wait upon OCS staff to provide an analysis; they simply point-and-click!



OCS Drought Monitoring Philosophy: Six Guiding Principles

Feedback from and collaboration with stakeholders has helped OCS forge a drought monitoring philosophy. The following six tenets guide the ongoing development of OCS drought monitoring efforts:

1. Drought is a social phenomenon. A widely accepted definition of drought is deceptively simple: It occurs when there is not enough water available to meet needs. This definition dictates that responsible decision-makers, and those who provide their information, approach an understanding of drought through the lens of these needs.

2. Drought is relative in time, space and application. Drought assessment must consider an ongoing interplay between scales. In Oklahoma, three intensifications of drought conditions occurred from 1998-2002. Were these separate droughts? It depends. To the state fire marshal, they were separate and severe events that exacerbated wildfire conditions. To farmers, they were three separate events whose impacts varied due to the time of year. To some reservoir operators, the period was essentially a single multi-year episode of varying intensity, as reservoir levels dropped and failed to recover throughout the period.

3. Because drought is intimately tied to society, a long-term reference is vital. Because people adjust to nature over generations, an objective measure of drought may have different impacts over time. For example, lessons learned during the droughts of the 1930s changed farming practices in the Plains. As a result, the impacts of the multi-year 1950s drought in Oklahoma were less severe, even though objective measures indicate a severity on par with the 1930s.

4. New and emerging observational datasets should be explored. Soil moisture observations from the Oklahoma Mesonet show promise for drought monitoring. They are independent of other drought-related variables, and are particularly effective during drought recovery, when they illustrate which precipitation events provide deep relief. The dataset also offers opportunities in research. Decomposing long-term events into individual episodes of precipitation and drying will isolate the building blocks of drought and recovery.

5. Drought is a multi-faceted issue and requires a multi-faceted assessment. Assessing drought is similar to assessing illness: more than one type of assessment is often necessary. A doctor does not make a diagnosis based on one temperature measurement. Instead, the doctor uses that observation in concert with other well-chosen indicators. A responsible drought decision-maker (and those who supply drought data) should take the same approach.

6. Deliver drought information, not just drought data. As the technology associated with delivering high-quality drought data improves, the ability to overwhelm stakeholders with volumes of numbers became a real problem. Finding the best balance between data volume and usability is an ongoing effort at the Climate Survey. Because many drought managers are from non-meteorological or even non-scientific fields, OCS conveys information with sensitivity to the varying people that process it. From an information perspective, some components of OCS's drought information suite overlap, with the anticipation that at least one will resonate with the particular learning style and experience of a client.